THE DESIGN OF A SHORT COURSE PROGRAM FOR THE EXECUTIVE DEVELOPMENT OF ENGINEERS

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By

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THE DESIGN OF A SHORT COURSE PROGRAM

FOR THE EXECUTIVE DEVELOPMENT OF ENGINEERS

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Chairman

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PREFACE

Engineering education has been recognized for its ability to instill an analytical method of thinking in those who successfully complete one of its various programs of study. This analytical thinking process is valuable in any endeavor. However, the vast store of technical knowledge available today, plus a trend toward specialization, has required that undergraduate curricula be devoted to engineering subjects to the virtual exclusion of liberal arts and business subjects. This narrow background has retarded and sometimes precluded an engineer's advancement in the ranks of management.

An apparent need exists for some means of providing engineers with a broader background so that they may cope adequately with the problems of modern management. This thesis is devoted to the investigation of one possible method of satisfying that need, namely an adult education short course program.

An attempt has been made to design a program which will be helpful to engineer-executives, or executives-to-be, in all types of manufacturing and processing plants, both large and small. Through this effort, it is hoped that some contribution has been made to Southern industrial progress.

In the execution of this research I am deeply indebted to my thesis committee--Colonel Frank F. Groseclose, Doctor Robert N. Lehrer, and Doctor James W. Sweeney--for their expert counsel and guidance.

Without the assistance of the National Association of Manufac-

turers, who carefully chose the Southern industrial executives to be surveyed, this study could not have been carried to a successful conclusion.

Acknowledgement is also made of the very helpful advise received from the staff of the Associated Industries of Georgia in the preliminary planning for this project.

Professor Roger S. Howell, Director of the Engineering Extension Division, Georgia Institute of Technology has made the facilities of his division available for conducting the research. Without this help, the work would have been extremely difficult.

To the members of my family, who performed the arduous task of proofreading this work and assisted me in so many other ways, goes my heartfelt thanks. I am especially grateful to my wife for her infinate patience and understanding, and constant encouragement.

R. E. E.

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Industry and education have awakened recently to the need for formal programs to train men and women for executive positions. Today's complex industrial plants can acquire specialists to do specific jobs without much difficulty, but locating people with executive capacity presents a definite problem. Most engineers have the required technical knowledge, but they lack the broad background essential for successful executives. For these reasons, research was performed on one possible method of developing the necessary background in engineering management personnel. The specific purpose of this research was to design a short course program which would aid in the development of the executive potential in engineers, especially engineers in Southern industry.

Twenty-three executive development short course programs, currently offered by colleges and universities, were studied. The results of that study were used as a basis for preparing a questionnaire by which the opinions of industrial executives were collected. Fifty-three top executives in Southern industry participated in the survey on executive development for engineers.

The 13 member Committee on Conferences and Institutes of the National University Extension Association was polled to ascertain the number of class hours which should be included in a short course. And the undergraduate curricula of 13 leading engineering schools were investigated to determine the adequacy of management course requirements in engineering curricula.

From the results of this research, the following conclusions were reached:

1. A short course program for the executive development of engineers is needed, and it is feasible.
2. The ideal short course program for the executive development of engineers is a series of three one-month sessions.
3. A three-month short course program for the executive development of engineers should include:

Hours	Subject
46	Personnel Administration
44	Production Management
39	Management Philosophy and Ethics
36½	Personal Development
34	Finance Management
31	Training Techniques
31	Administrative Structures
28	Marketing Management
27½	Managerial Accounting
24½	Public Relations
18½	Business in the American Economy.

The research was intended to determine only the broad subjects

to be included in such a short course. Further study is needed to ascertain what areas or subdivisions of the subjects should receive most attention.

For the purposes of this project, it was assumed that anyone with an engineering degree would be eligible for admission to the executive development short course for engineers. Further research is needed to decide if executive potential in an engineer can and should be defined and measured before accepting applicants.

Approved, June 2, 1955:

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CHAPTER I

INTRODUCTION

General History of Executive Development Programs

Prior to the 1940's, scant attention was given to the subject of executive development. A few colleges and universities offered management training, mostly at the undergraduate level where it was treated on a basic plane. Aside from this, the development of executive personnel was conducted in an informal and subsidiary manner within business organizations. For the most part this training was of a haphazard nature, and in most instances the business organization did not realize that an educational process was taking place.

The advent of World War II ushered in an era that was to make the need for trained executives a critical factor in the economic life of the United States. This country was relatively unprepared for war. Industry had to expand rapidly and convert to the production of materials essential to the armed forces. This expansion, of course, required more executives than had been needed ever before in the history of the world.

Since the young men, many of whom were middle-management people, were needed in the armed services, industry had to rely heavily upon the middle aged and older men with proved executive ability to administer the expanding industrial program. Many of these men were called into the armed services for special assignments, making the need for

trained executives even more critical. Although many executives were called out of retirement in the emergency, there were not enough to fill the need. Untrained men, men without experience, had to be elevated to positions of responsibility.

For the first time, business men and educators were brought face to face with the need for a formal program of education to develop executive potential in men in management positions or on the way to those positions. Since almost everyone was required to work overtime, it was not feasible to have men away from their plants to take executive training. Therefore, it was only logical that formal programs within the plants themselves be utilized. This training was done extensively during World War II and proved of such value that in-plant programs have been continued.

The end of hostilities with Germany and Japan did not alleviate the need for trained executives. Industry converted many of its expanded facilities to peacetime production. A prolonged period of prosperity has followed. Of those executives who were relied upon during the war, many retired or died. Many of the young executives who were called into the armed services did not return. Those who did come back had matured in age but not necessarily in executive ability. Their training had been arrested, and they were not ready to replace their former supervisors. The need for formal executive training programs was more pronounced than ever.

In-Plant Executive Development Programs

Many industries now have in-plant executive development programs.

Although Dooher and Marquis (1) found these programs to be as different as they are numerous, they found that they all had one aim: to give the prospective executive the broad background essential to success at the top management level.

Many tools and techniques have been used in the in-plant programs. Planty (2) has summarized those most frequently used:

1. Committee assignments
2. Case study
3. Job rotation
4. Conference method
5. Multiple management
6. Role playing
7. The syndicate system
8. Counseling by staff specialists or outside consultants
9. Guided experience.

Mace (3) uses the term "coaching" instead of "guided experience", but both mean the same thing. Mace and Planty agree that this is the most effective method of learning. It is a method of learning by doing under the sympathetic and able guidance of a superior. Mace divides the elements of coaching into these five major segments:

1. Subordinates must be given opportunities to perform.
2. The superior must counsel subordinates, using the work situation as a framework for counseling.
3. The superior must create a team of his subordinates, sometimes described as motivation.
4. The relationship between superior and subordinate must be characterized as one of mutual confidence, a climate of confidence.

5. The superior must set the standards of performance.

University Programs for Executive Development

After the emergency period of World War II was over, industry began to look to the colleges and universities for help in developing executives. These institutions responded by initiating executive development programs at the graduate and adult education levels. These programs were not intended to replace in-plant training but rather to supplement it and accelerate the educational process.

University programs in executive development have been established in many leading schools in this country, Canada, and Great Britain (4, 5, and 6). Some of these programs appeal to executives in general, such as Harvard's Advanced Management Program (7) and the University of Chicago's Refresher Courses (8). Other programs are for specific industries, such as the Public Utility Executive Courses at the Georgia Institute of Technology and the University of Michigan (9).

There are many valid reasons for having university executive development programs over and above in-plant programs. Planty (4) is the author of this convincing summary of these reasons:

1. Operational pressures and tensions are relieved by prolonged absence from work. This does not happen in one or two hour classes held within the plant.

2. University programs bring together men from a variety of occupational skills and industries. These associations have a broadening effect.

3. Executives tend to "loosen up" when away from the scrutiny of their associates.

4. Academic men, secure in their jobs, can deal with the sometimes overconfident executive better than a plant training director.

5. Not every industry can afford to hire a trained educator.

6. Skilled training men are not always available even if finances are.

7. Universities offer a variety of teaching specialists which con't be reproduced even in the largest industries.

The Engineer and Executive Development

Despite all of the work which has been done in the field of executive development since World War II, very little attention has been focused on the engineer. Most of the programs developed specifically for this profession have lasted from thirteen weeks to two years, and in many instances the longer programs have led to a master's degree. In a majority of cases where an engineer needs and wants training to help promote him at the management level he is not particularly interested in getting an advanced degree, and it is extremely difficult to be away from work for a three to twenty-four month period in order to take this training.

Undoubtedly engineers would derive much from a general executive development program. Why, then, should attention be focused on the engineer? Why not let him attend the same executive development courses as other people? There are several factors which warrant special emphasis in a program specifically for engineers. The abundance of technical knowledge, the ever-increasing complexity of that knowledge, and a trend toward specialization have had such influence that engineering curricula today include very few non-technical subjects. However, it takes a broad and general knowledge of a multitude of subjects to be a successful executive. Also, it is in industry, where most engineers are

employed, that a majority of openings for executives occur.

A study made in 1948 by evens (10) revealed that most executives come from two professional groups, the bankers and lawyers. The reason given for the fact that no more executives came from the ranks of the engineering profession was the dearth of engineers with a broad enough background. However, Evan's survey also revealed that 50 of the 150 largest companies in the United States were headed by engineers. This fact indicates that there is considerable executive potential in the engineering profession.

A 1954 study by Walters (11) showed that within 20 years after graduation 3/5 of all engineers were engaged in functions which were classified as administrative. In spite of this and a statement by the Engineers Council for Professional Development that 40 per cent of all industrial executives are engineers, Walters' survey revealed a general impression that engineers are not good administrators.

Educators in the field of engineering are confronted with this challange: they must provide some means of helping the graduate engineer prepare himself to step up the ladder to top management positions. This must be a program in which it is practical and feasible for the engineer to participate.

Research has been performed on one possible solution to the problem of providing engineers with the neccessary background to be successful executives. Specifically, the purpose of the research was to design a short course program to develop the executive potential in engineers. Involved in this research was the determination of the length of the program, what subjects should be included, and the time to be devoted to each of the subjects.

CHAPTER II

RESEARCH PROCEDURE

Twenty-three executive development short course programs, currently offered by colleges and universities, were studied. The results of that study were used as a basis for preparing a questionnaire by which the opinions of 53 top Southern industrial executives were collected. Also, the 13 member Committee on Conference and Institutes of the National University Extension Association was polled to ascertain the number of class hours which should be included in a short course. The undergraduate curricula of 13 leading engineering schools were investigated to determine the adequacy of management course requirements in engineering curricula. The details of this procedure are enumerated in the sections which follow.

Short Course Design Considerations

In attacking the problem of designing a short course for the executive development of engineers, three factors were critical:

1. Who shall be eligible for training?
2. What subjects should be included in the short course?
3. How should the subject matter be taught?

Some work has been done on psychological measurements for the selection of executives by Thompson of the University of Omaha (12), Gardner of Social Research, Inc. (13), Rupp of Purdue University (14), and others. However, there is no agreement at this time on factors

that make a successful executive other than that he must have a broad background. He can not be a specialist.

That is an area for research within itself, and since this study was to be focused on engineers it was decided to assume that successful completion of the requirements for a bachelor of science degree in engineering would suffice as a selective device to determine who would be eligible for the training.

Another area of research within itself is the field of educational methods. After the subject matter for a course has been determined, the method by which the course content will be presented must receive careful consideration. However, for the purposes of this study it is assumed that if professional educators who are competent in the fields to be covered are employed, they can adequately develop the details of presentation.

The crux of this problem, then, centers on the second item. What subjects should be included in the short course?

Short Course Subject Matter Determination

Investigation of existing executive development short courses.--It was decided to analyze the curricula of the executive development courses currently being offered to obtain a consensus from leading educators as to which subjects are important. Presumably, these programs were established after careful thought and with the guidance of carefully selected planning committees.

Before a course was analyzed it had to meet these three requirements:

1. It must have been conducted by a reputable institution of higher education.

2. It must have been a short course, i.e., no longer than one year in duration.

3. It must have been a current offering, i.e., conducted during 1954.

Twenty-three programs in the field of executive development were found which met these requirements (see Appendix, p. 37). A tabulation of the subject content of these programs revealed that there were 12 subject matter areas included in two or more of the programs (see Table 1.). These 12 subjects were used as a base from which to work in determining what should be the subject content of a short course for the executive development of engineers.

How do top industrial executives feel about what should be included in a short course for the executive development of engineers? An answer to this question could be an excellent criterion by which to design such a short course.

Design of the questionnaire.--A questionnaire was prepared by which top industrial executives could be sampled to get their opinion regarding this matter (see Appendix p. 41). In the design of the questionnaire, the following factors were taken into account:

1. The executives to be sampled are extremely busy. Therefore, the questionnaire should be short, clear, and concise.

2. The questionnaire should supply some convenient way to rate the subjects included in existing short courses on executive development.

3. Provision should be made for the executive to add subjects to the list and rate the new subjects against the others.

4. Pertinent information, beside the subject content of the short course, should also be gathered.

Table 1. Short Course Subjects--Existing Programs

Ranked according to the number of times they were included in 23 executive development short courses conducted currently.

Number	Subject	Frequency of Inclusion
1	Personnel Administration	22
2	Management Philosophy and Ethics	19
3	Business in the American Economy	15
4	Finance Management	15
5	Marketing Management	13
6	Administrative Structures	10
7	Managerial Accounting	9
8	Government Regulations	8
9	Public Relations	7
10	Production Management	5
11	Personal Development	5
12	Training Techniques	4

To fulfill the requirements of 2. and 3. above, a paired comparison chart (15) was selected. This chart provided a convenient way to compare each subject against each of the other subjects. The chart also made it possible to add subjects and still compare each against the others including the new subjects.

One minor disadvantage was connected with the use of the paired comparison chart: the subjects could not be compared in a completely random manner. Each subject had to be compared with the others in the same order each time. To minimize the effects of the bias which might result from this, the 12 subjects included on the chart were set up in rank order according to the number of times they were included in the curricula of the 23 short courses analyzed. The subjects then were numbered consecutively and rearranged in a random fashion using a table of random numbers (16).

The paired comparison chart produced two significant results. First, it revealed the executives' opinions as to the relative importance of the subjects to be included in a short course on executive development for engineers. Second, it disclosed the percentage of the short course time which should be devoted to each of the subjects, according to the executives' opinions.

In completing the paired comparison chart the executives indicated which of the subjects was more important by placing the number of the preferred subject in the appropriate box. Each executive performed 66 of these comparisons using the 12 subjects. In effect the executive voted 66 times, casting from zero to 11 votes for each subject as a result. A count of the votes cast for each subject then provided

the means of determining how the executives rated the subjects according to their importance. The number of votes cast for each subject divided by the total of all the votes cast for all the subjects gave a measurement for determining what percentage of the short course time should be devoted to each subject.

Five pieces of information aside from the subject matter content of the short course were deemed pertinent to this study. The following questions were included in the questionnaire:

1. Number of employees?
2. Do you operate any form of executive development program in your plant?
3. Do you feel that the executive potential in engineers can be developed through a short course?
4. What is the shortest length of time you think would be required to develop the executive potential in engineers through a program of this nature?
5. What is the greatest length of time you think it would be feasible for an engineer with executive potential to be away to attend such a development program?

Selection of survey participants.--Since the South is one of the fastest growing industrial areas in the United States it was decided to orient this study to the South. The 16 states covered by the Blue Book of Southern Progress published by the Manufacturers Record Publishing Company were selected as those in which executives would be polled. These states are Alabama, Arkansas, Georgia, Kentucky, Louisiana, Florida, Maryland, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

The National Association of Manufacturers selected seven top executives in each of the 16 states, and these 112 men were asked to

participate in the study. In making the selections N. A. M. kept the following points in mind.

1. The plants should be autonomous in their operation.
2. They should be either manufacturing or processing plants.
3. A wide variety of products should be represented.
4. Small, middle size, and large plants should be represented in approximately equal numbers.
5. The management of the plants selected should have the reputation of being sound and progressive.

To emphasize the importance of the survey and to encourage return of the questionnaires, a personal letter was written to each of the 112 executives. Enclosed with the letter was a questionnaire, an addressed and stamped envelope, and a page of general information concerning the study (see Appendix pp. 39, 40, 41). The information sheet contained a brief background to the study and a list of the subjects contained in the paired comparison chart. Alternate descriptive titles and subheadings were included to make clear the content of each subject and to orient the thinking of the various executives for the sake of uniformity.

Short Course Hours of Instruction

As a means of ascertaining the number of short course hours available for classroom instruction, the 13 members of the National University Extension Association Committee on Conferences and Institutes (see Appendix p. 42) were polled. They were asked the following questions regarding short courses:

1. How many hours of classroom instruction per day do you recommend?

2. Do you recommend that classes meet every Saturday, every other Saturday, or no Saturdays?

3. Do you recommend that classes be conducted for the full day on Saturday or for half a day?

Realizing that every short course must be arranged to meet specific needs and circumstances, the result of this poll furnished a consensus of the typical short course schedule based on the opinions of persons experienced in conducting such programs.

Confirming the Need

In order to help verify the need for an executive development program in the engineering profession, the curricula of the leading engineering schools in the United States were investigated to determine the amount of time devoted at the undergraduate level to the subjects important to the successful industrial executive.

As a means of selecting the schools to be analyzed, 41 men in administrative positions at the Georgia Institute of Technology were asked to name the ten colleges or universities which they thought had the best undergraduate engineering curricula. These administrators were not asked to rank them but merely to name the top ten.

Thirteen schools were included in at least 1/3 of the returns:

1. California Institute of Technology
2. University of California at Berkley
3. Carnegie Institute of Technology
4. Cornell University
5. Georgia Institute of Technology
6. Illinois Institute of Technology

7. University of Illinois
8. Massachusetts Institute of Technology
9. University of Michigan
10. Ohio State University
11. Pennsylvania State University
12. Purdue University
13. Rensselear Polytechnic Institute.

The undergraduate chemical, civil, electrical, and mechanical engineering curricula were studied to ascertain the number of quarter hours of management subjects required in each. These four curricula were chosen because they represent the largest number of graduates.

The data was tabulated and analyzed for significant results. A few of the returned questionnaires were incomplete, but the completed portions were included in the tabulations. Where the paired comparison charts were not filled out according to directions the answers given were omitted from the tabulations.

CHAPTER III

DISCUSSION OF RESULTS

Nature of Survey Replies

Fifty-three of the 112 executives invited to participate in the study on executive development for engineers returned completed questionnaires. This is a return of 47 per cent, and is much better than the usual return received in polls of this nature.

Replies were received from companies employing as few as 28 people and as many as 18,000 with good distribution within that range (see Table 2.). Upon analysis of the replies from the various companies, a few differences were observed in the answers received from companies employing less than 1,000 people and those employing more than that number. By coincidence, the number of replies received was almost evenly divided between these two size groups: 53 per cent from those employing less than 1,000, 47 per cent from those employing more than 1,000. For the purposes of this discussion, these two groups will henceforth be referred to as small and large companies, and the observed differences will be pointed out.

In-Plant Programs

The first question asked of the executives was, "Do you operate any form of executive development program in your plant?" Forty per cent replied in the affirmative (see Table 3.). Since 60 per

Table 2. Survey Replies by Size of Company

Number of Employees	Number of Companies Replying	Per Cent of Replies
1 to 99	3	6%
100 to 499	17	32
500 to 999	8	15
1000 to 4999	18	34
5000 and over	7	13
1 to 999	28	53
1000 and over	25	47
Total	53	47*

* Per cent of 112 questionnaires distributed.

Table 3. In-Plant Executive Development Programs

A tabulation of the replies to the question, "Do you operate any form of executive development program in your plant?"

Number of Employees	Number of Companies Replying	Number Having In-Plant Programs	Per Cent of Replies
1 to 99	3	0	0%
100 to 499	17	5	29
500 to 999	8	2	25
1000 to 4999	18	9	50
5000 and over	7	5	71
1 to 999	28	7	25
1000 and over	25	14	56
Total	53	21	40

cent of the plants still do not have executive development programs, there is considerable opportunity for assisting industry in developing executives.

As might be expected, more large plants had executive development programs than did small ones. Fifty-six per cent of the large companies operated in-plant training programs for executives while only 25 per cent of the small concerns did. Financial considerations probably cause this difference. The expense involved in employing a training director might be prohibitive for the small plant, and herein lies an opportunity and an obligation for educational institutions to be of service through executive development programs.

Short Course Feasibility

The second question asked of the executives was, "Do you feel that the executive potential in engineers can be developed through a short course?" Seventy-nine per cent answered this question, "yes" (see Table 4.). This large percentage of affirmative replies indicates that such a program could be exceedingly valuable to industry.

Eighty-six per cent of the small companies and 72 per cent of the large ones felt that a short course could be effective. While this difference is not sufficient to warrent a definite conclusion, it does indicate that universities might be particularly helpful to small plants in developing executives.

Comments made by the executives (see Appendix p. 43) emphasize the need for an executive development program for engineers. William D. Owsley, Vice President of Halliburton Oil Well Cementing Company, made

Table 4. Short Course Feasibility

A tabulation of replies to the question, "Do you feel that executive potential in engineers can be developed through a short course?"

Number of Employees	Number of Companies Replying	Number of Affirmative Replies	Per Cent of Replies
1 to 99	3	3	100%
100 to 499	17	15	88
500 to 999	8	6	75
1000 to 4999	18	13	72
5000 and over	7	5	71
1 to 999	28	24	86
1000 and over	25	18	72
Total	53	42	79

this typical comment, "I am of the opinion that a short course pointed toward executive development in engineers is very badly needed."

Required Length of Short Course

Replies to the question, "What is the shortest length of time you think would be required to develop the executive potential in engineers through a short course program?", revealed little agreement in this matter. A frequency distribution of the answers (see Table 5.) showed that 17.1 per cent of the executives considered one month sufficient while 21.9 per cent chose three months and another 17.1 per cent thought it would take at least a year. It is significant, however, that the mode of the frequency distribution for the small plants was three months while the mode for the larger companies was only four weeks. This is probably a reflection of the fact that more of the larger plants have in-plant executive development programs.

More than half of the executives in both the large and small plants thought that three months or more would be required to develop the executive potential in engineers. Therefore, a short course, or series of short courses, designed for less time would probably be inadvisable.

Leave-Time Permissable for Short Course Attendance

The length of time required to develop executive potential is a vital consideration. But from a practical standpoint, the length of time that is feasible for an engineer to be away from work to attend a development program is of equal importance. In reply to the question regarding this, 88.1 per cent of the executives indicated they could

Table 5. Required Length of Short Course

A frequency distribution of replies to the question, "What is the shortest length of time you think would be required to develop the executive potential in engineers through a short course program?"

Short Course Time	Replies From Small Companies*		Replies From Large Companies**		Replies From All Companies	
	No.	%	No.	%	No.	%
1 to 3 weeks	4	21.1	0	0	4	9.8
1 month	1	5.3	6	27.2	7	17.1
6 to 9 weeks	4	21.1	4	18.2	8	19.5
3 months	5	26.3	4	18.2	9	21.9
4 to 9 months	2	10.5	4	18.2	6	14.6
1 year	3	15.7	4	18.2	7	17.1

* 1 to 999 employees.

** 1000 or more employees.

spare the engineer for at least four weeks (see Table 6.), but only 28.6 per cent said that he could be away longer than three months. This seems to show that a short course in executive development for engineers could be successfully conducted if it were from four weeks to three months long. However, it must be remembered that these were maximum times for being away from the plant. Also, only 64.3 per cent said the engineer could be away more than four weeks, and only 47.6 per cent said he could be away for as much as three months. Based on these figures, it seems advisable to limit the short course to four weeks or to have a series of short courses lasting four weeks each.

Paired Comparison Chart Results

The most convenient way to determine the importance which the executives placed on each of the subjects was to count the total number of times each subject was preferred over the other subjects (see Table 7.). To confirm this ranking, the ratings each executive gave to each subject were tabulated and frequency distributions made (see Appendix p. 45). From the frequency distributions, it was noted that every subject was ranked fourth or higher by at least one executive. The percentage of the total of the number of one, two, three, and four ratings given each subject was computed. From this, it was determined what percentage of the executives thought each subject should be in the upper 1/3 of the 12 subjects in order of importance. These figures were used to arrange the subjects in rank order in Table 8., and this ranking agreed with that given in Table 7., adding validity to the ranking.

Table 6. Leave-Time Permissable for Short Course Attendance

A frequency distribution of top executive replies to the question, "What is the longest length of time you think would be feasible for an engineer with executive potential to be away to attend a short course for executive development?"

Short Course Time	Replies From Small Companies*		Replies From Large Companies**		Replies From All Companies	
	No.	%	No.	%	No.	%
1 to 3 weeks	3	15	2	9.1	5	11.9
1 month	6	30	4	18.2	10	23.8
6 to 9 weeks	2	10	5	22.7	7	16.7
3 months	5	25	3	13.6	8	19.0
4 to 9 months	3	15	4	18.2	7	16.7
1 year	1	5	4	18.2	5	11.9

* 1 to 999 employees.

** 1000 or more employees.

Table 7. Short Course Subjects--Executive Preference

Ranked according to the number of times each was preferred over one of the others (number of votes received).

Number	Subject	Number Of Votes Received	Per Cent Of Votes
1	Personnel Administration	350	12.4%
2	Production Management	338	12.0
3	Management Philosophy and Ethics	297	10.5
4	Personal Development	278	9.9
5	Finance Management	262	9.3
6	Training Techniques	238	8.4
7	Administrative Structures	238	8.4
8	Marketing Management	216	7.7
9	Managerial Accounting	209	7.4
10	Public Relations	186	6.6
11	Business in the American Economy	143	5.1
12	Government Regulations	66	0.3

Table 8. Short Course Subjects--Upper Third

Ranked according to the number of executives who rated them as number one, two, three, or four (upper 1/3) in order of importance among the 12 subjects.

Number	Subject	Number Of Times Rated In Upper 1/3
1	Personnel Administration	31
2	Production Management	29
3	Management Philosophy and Ethics	25
4	Personal Development	20
5	Finance Management	17
6	Training Techniques	16
7	Administrative Structures	15
8	Marketing Management	11
9	Managerial Accounting	10
10	Public Relations	10
11	Business in the American Economy	4
12	Government Regulations	1

Table 9. Short Course Hours of Instruction

A tabulation of the results obtained from a poll of the Committee on Conferences and Institutes of the National University Extension Association.

Instruction Period	Number Of Replies	Per Cent Of Replies
4 to 6 hours per day	1	8%
6 hours per day	7	54
6 to 8 hours per day	2	15
7 hours per day	1	8
7½ hours per day	2	15
Meet Every Saturday	3	23
Meet Every Other Saturday	2	15
Meet No Saturdays*	8	62
Classes Full Day Saturday	1	8
Classes Half Day Saturday*	11	92

* With one exception all replies indicated Saturday classes would be conducted under certain circumstances but recommended no Saturday classes

Only six executives added a subject to the paired comparison chart. These subjects were: human relations (twice), creative thinking, common horse sense, planning and control, and world economy. Human relations was included as an alternate descriptive title for personnel administration on the general information sheet sent the executives. The fact that two of them pulled it out, and stated that they did so for emphasis, gives more evidence that this subject area should be the one most thoroughly covered in a short course for the executive development of engineers.

Since each of the subjects added could conceivably be included in one of the 12 subject areas voted on by all the executives and since the percentage of votes which each received was so small, they were not included in the tabulations. However, cognizance of these additions should be helpful in planning a short course in the field of executive development.

Short Course Time to be Devoted to Each Subject

A poll of the National University Extension Association Committee on Conferences and Institutes was conducted to obtain information regarding the typical short course schedule. This committee is composed of 13 experienced short course directors and their replies are tabulated in Table 9. The mean of their replies obviously has little significance, so the mode was selected as the measurement of central tendency. From this consensus, the following schedule of short course instruction periods can be considered typical:

Monday through Friday--six hours per day.

Saturday--no classes.

Based on this schedule, short courses should contain the following number of class hours:

One-week short course	30 hours
One-month short course	120 hours
Three-month short course	360 hours

Using these figures and the percentage of the short course time to be devoted to each subject, the number of hours allotted to each subject area has been computed and tabulated in Table 10. Since the subject area of government regulations received only 0.3 per cent of the total votes cast, it was not included. The percentage of the total votes which each subject received was re-calculated leaving out the 66 votes given government regulations, and these figures were used in distributing the short course time.

Management Courses Required in Undergraduate Engineering Curricula

From the study made of the chemical, civil, electrical, and mechanical undergraduate engineering curricula in 13 leading engineering schools, it was found that an average of only 11.6 quarter hours of work was required in the subject areas deemed necessary for executive development. This amount of work is equivalent to a one-month short course in terms of class hours. Several factors indicate that it is inadequate:

1. Fifty-one per cent of the executives polled felt that it would take three months or more to develop the executive potential in engineers.

Table 10. Distribution of Short Course Time

Subject	Number Of Votes Received	Per Cent Of Votes Received	Hours Devoted In Short Course Of: 1 week	1 month	3 months
Personnel Administration	350	12.7%	4	15½	46
Production Management	338	12.3	3½	14½	44
Management Philosophy and Ethics	297	10.8	3	13	39
Personal Development	278	10.1	3	12	36½
Finance Management	262	9.5	3	11½	34
Training Techniques	238	8.6	2½	10½	31
Administrative Structures	238	8.6	2½	10½	31
Marketing Management	216	7.8	2½	9½	28
Managerial Accounting	209	7.6	2½	9	27½
Public Relations	186	6.8	2	8	24½
Business in the American Economy	143	5.2	1½	6	18½
Totals	2755	100	30	120	360

2. The management courses required in undergraduate engineering curricula are basic in nature.

3. Forty-five per cent of the management work required in undergraduate engineering curricula is in the principles of economics, the subject ranked number 11 by the executives.

4. Only 1.1 per cent of the management work required in undergraduate engineering curricula is in the area of personnel administration, the subject rated first in order of importance by the executives.

Only two of the schools studied require more than an average of 15 quarter hours of management subjects in their curricula. California Institute of Technology requires an average of 24 quarter hours, and Cornell University requires an average of 21. If these two schools are omitted from the computations, the average management subject requirement in the curricula of the 11 remaining schools would be only 9.6 quarter hours. Three chemical, two electrical, and one mechanical engineering curricula studied required no management subjects. These facts make the inadequacy of undergraduate programs and the need for an executive development program even more apparent.

CHAPTER IV

CONCLUSIONS

The following conclusions were reached by studying the content of 23 existing executive development short course programs, analyzing information received from 53 top Southern executives, examining replies from 13 experienced short course directors, and investigating the undergraduate curricula of 13 leading engineering schools.

Program Needed

The relatively small number of plants having executive training programs, the comments received from executives, and the lack of management subjects required in undergraduate engineering curricula, all indicate a substantial need for a program to develop the executive potential in engineers.

Short Course Program Feasible

According to 79 per cent of the executives surveyed, it is possible to develop the executive potential in engineers through a short course program.

Short Course Program Length

A good short course program for the executive development of engineers would be a series of three one-month sessions. This statement is substantiated by the following facts:

1. Sixty-eight per cent of the executives polled believed that the executive potential in engineers could be developed through a three-month program.

2. Ninty per cent of the executives thought it feasible for an engineer to be away from his work one month to attend an executive development program, while only 48 per cent felt a three-month leave at one time would be practical.

Short Course Program Content

A three-month short course program for the executive development of engineers should include:

Hours	Subject
46	Personnel Administration
44	Production Management
39	Management Philosophy and Ethics
36½	Personal Development
34	Finance Management
31	Training Techniques
31	Administrative Structures
28	Marketing Management
27½	Managerial Accounting
24½	Public Relations
18½	Business in the American Economy.

CHAPTER V

RECOMMENDATIONS

Short Course Establishment

It is recommended that a short course program for the executive development of engineers, consisting of three one-month sessions, be inaugurated, and that the short course include:

Hours	Subject
46	Personnel Administration
44	Production Management
39	Management Philosophy and Ethics
36½	Personal Development
34	Finance Management
31	Training Techniques
31	Administrative Structures
28	Marketing Management
27½	Managerial Accounting
24½	Public Relations
18½	Business in the American Economy.

Scope of Short Course Subjects

One of the primary purposes of this research was to determine the subject areas which should be included in a short course program for the executive development of engineers. The scope of these

subjects was defined in a general way, but no attempt was made to decide which topics or subdivisions within each subject area should receive most attention Before an effective short course can be established, research must be performed to make this determination.

Short Course Student

For the purposes of this project, it was assumed that anyone with an engineering degree would be eligible for admission to the executive development short course for engineers. Research is needed to decide whether executive potential in an engineer can and should be defined and measured before accepting him in an executive development short course.

Programs for Different Size Companies

Information gathered from top industrial executives in the South indicates that executive development problems in companies employing less than 1,000 people are different from those in larger concerns. However, the data collected was not sufficient to warrant conclusions regarding these differences. A more extensive study should be made to ascertain the significance of these differences and to determine if they justify designing short course programs for the executive development of engineers in various size plants.

A P P E N D I X

TWENTY-THREE EXECUTIVE DEVELOPMENT SHORT COURSE PROGRAMS CURRENTLY OFFERED BY COLLEGES AND UNIVERSITIES

Administrative Staff College, The--Greenlands, Henley-on-Thames, Oxon, England. Twelve-weeks program.

Agricultural and Mechanical College of Texas--College Station, Texas. Executive Development Program--three weeks.

University of Alberta--Edmonton, Alberta, Canada. Executive Course in Business Administration--six weeks.

University of Buffalo--Buffalo, New York. Executive Development Program--three weeks.

University of California--Los Angeles, California. Executive Program--two evenings per week, two semesters.

Carnegie Institute of Technology--Pittsburgh, Pennsylvania. Program for Executives--nine weeks (two sessions).

University of Cincinnati--Cincinnati, Ohio. Advanced Management Course for Executives--three afternoons per week, 12 weeks.

Cornell University--Ithaca, New York. Executive Development Program--six weeks.

Georgia Institute of Technology--Atlanta, Georgia. Public Utility Executive Course--four weeks.

University of Georgia--Athens, Gerogia. Executive Development Program--four weeks.

Harvard University--Boston, Massachusetts. Advanced Management Program--13 weeks.

University of Houston--Houston, Texas. Southwest Executive Development Program--six weeks.

Indiana University--Bloomington, Indiana. Executive Development Program--two sessions of three weeks each.

University of King's College--Halifax, Nova Scotia. Management Training Course--five weeks.

University of Michigan--Ann Arbor, Michigan. Executive Development Program--four weeks.

University of North Carolina--Chapel Hill, North Carolina. The Executive Program--two weeks full time and eight alternate week-ends.

Oklahoma Agricultural and Mechanical College--Stillwater, Oklahoma. Executive Development Course--three weeks.

University of Pennsylvania--Philadelphia, Pennsylvania. Executive Conference on Administrative Policies and Problems--two weeks annually.

University of Pittsburgh--Pittsburgh, Pennsylvania. Management Problems for Executives--eight weeks.

Stanford University--Stanford, California. Executive Development Program--nine weeks.

University of Washington--Seattle, Washington. Advanced Management Seminar--six weeks.

University of Western Ontario--London, Ontario, Canada. Management Training Course--five weeks.

The University of Wisconsin--Madison, Wisconsin. Executive Leadership Program--two weeks.

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA
ENGINEERING EXTENSION DIVISION
SHORT COURSES AND CONFERENCES

April 2, 1955

Mr. Robert S. Lynch, President
Atlantic Steel Company
Atlanta, Georgia

Dear Mr. Lynch:

Your very responsible position in industry gives evidence that you possess that rare quality of sound judgement so necessary for effective industrial leadership. For this reason, you have been chosen as one of seven men in your state to participate in a study of "Executive Development For Engineers".

This study has three purposes:

1. To determine if, in the minds of top industrial executives, a short course designed to develop the executive potential in engineers is desirable and feasible;

2. To determine what subjects should be included in such a short course; and

3. To help the writer complete the requirements for his Master of Science Degree in Industrial Engineering.

Your time is valuable; this I realize. It is anticipated that, although thoughtful answers are desired, it will require very little of your time to read the enclosed information and answer the questionnaire.

However, if you do not feel that you have time to participate in this survey, or if you do not care to complete the questionnaire for any other reason, please return it unanswered.

In any event, please return the questionnaire. April 15, 1955 is the target date for completing this survey.

Your cooperation will certainly be appreciated.

Sincerely yours,

R. E. Eskew, Coordinator
Short Courses & Conferences

REE:BE

Enclosures (3)

Survey

General Information:

Executive development programs have been widely accepted today as a very worthwhile tool for bringing to fruition the leadership potential in management personnel.

Executive development programs may be divided into two large areas, in-plant programs and university programs. In-plant programs are "tailor made" to the situation and deal to a great extent with specific problems unique to the plant. University programs are more general in nature giving the executive the broad background necessary for skilled evaluation of the circumstances surrounding industrial and business problems, and so essential to intelligent decision making. The two areas complement each other.

Formal engineering education has of necessity confined itself to the technical aspects of the profession. In a great many cases this has left men with leadership potential devoid of the general knowledge necessary for the executive to perform as he should.

Some attention has been paid to the plight of the engineer aspiring to management positions, but the programs established have been for thirteen weeks to two years duration. In many instances it is not feasible for a man to be away from his work for this length of time. Thus the reason for this study.

In this study it has been hypothesized that a short course program can be designed through which the executive potential in engineers can be developed. To help prove or disprove this hypothesis a questionnaire has been designed. It consists of several straight forward questions and a chart for evaluating a number of subjects by the method of "paired comparisons". The subjects included in this chart are those offered in two or more executive development programs currently being conducted. Twenty-three programs, of less than a year duration, offered by universities in the United States, Canada, and England were studied.

Listed below are the subjects found in the paired comparison chart with alternate titles or sub-headings descriptive of the subject. You are encouraged to add subjects which you think important and are not covered by one of those already listed.

1. PRODUCTION MANAGEMENT - (Plant and Equipment, Material and Production Control, Process Analysis)
2. GOVERNMENT REGULATIONS - Business-Government Relations
3. TRAINING TECHNIQUES - (Conference Leadership, Role Playing)
4. PERSONAL DEVELOPMENT - (Rapid Reading, Public Speaking)
5. PUBLIC RELATIONS - External Relations, Community Relations
6. FINANCE MANAGEMENT - Cost Administration, Investment Management
7. PERSONNEL ADMINISTRATION - Industrial Relations, Human Relations, Labor Relations, Internal Relations
8. ADMINISTRATIVE STRUCTURES - Business Organization
9. MARKETING MANAGEMENT - Sales Management, (Advertising)
10. MANAGEMENT PHILOSOPHY AND ETHICS - Administrative Practices, Management Policy Formulation and Interpretation, Business Polocies, Management Fundamentals
11. MANAGERIAL ACCOUNTING - Budgeting
12. BUSINESS IN THE AMERICAN ECONOMY - Economics, (Taxation)

EXECUTIVE DEVELOPMENT FOR ENGINEERS
Survey

QUESTIONNAIRE:

Nature of your business or product _____. Number of employees _____.

Do you operate any form of executive development program in your plant? ☐ yes ☐ no

Do you feel that the executive potential in engineers can be developed through a short course? ☐ yes ☐ no

What is the shortest length of time you think would be required to develop the executive potential in engineers through a program of this nature? _____

What is the longest length of time you think it would be feasible for an engineer with executive potential to be away to attend such a development program? _____

PAIRED COMPARISON CHART. This chart provides a method of rating each subject against each of the other subjects on the chart. Please make any additions you wish to the list of subjects. This should be done before you begin the rating process by writing in your first addition by the number (13) at the top and at the side of the chart, your next addition by the numbers (14), etc. To accomplish the rating first run down the column under subject no. 1 (Production Management) at the top of the chart. As you come to each blank box compare subject no. 1 with the subject on the horizontal line to the left of the box, and place in the box the number of the subject which you think the more important of the two. When you have filled in the boxes under subject no. 1 start down the column under subject no. 2 (Government Regulations) performing the same process, and so on until all of the boxes have been filled.

PAIRED COMPARISON CHART	1 Production Management	2 Government Regulations	3 Training Techniques	4 Personal Development	5 Public Relations	6 Finance Management	7 Personnel Admin.	8 Admin. Structures	9 Marketing Management	10 Mgt. Philosophy & Ethics	11 Managerial Accounting	12 Busn. In The Amer. Economy	13	14	15
1 Production Management															
2 Government Regulations															
3 Training Techniques															
4 Personal Development															
5 Public Relations															
6 Finance Management															
7 Personnel Administration															
8 Administrative Structures															
9 Marketing Management															
10 Management Philosophy And Ethics															
11 Managerial Accounting															
12 Business In The American Economy															
13															

ANY COMMENT WHICH YOU WISH TO MAKE ON THE BACK OF THIS SHEET WILL BE SINCERELY APPRECIATED.

N.U.E.A. COMMITTEE ON CONFERENCES AND INSTITUTES, 1954-1955

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COMMENTS REGARDING AN EXECUTIVE DEVELOPMENT SHORT COURSE FOR ENGINEERS QUOTED FROM LETTERS RECEIVED FROM TOP INDUSTRIAL EXECUITVES IN THE SOUT

In my own case, an engineering background was a useful base from which to proceed to executive accomplishments. I could have gone farther with a better #4, #8, #9, #11. "MORE LIBERAL ARTS FOR THE ENGINEER."

M. J. Davis, President
Hammond Bag & Paper Company
Wellsburg, West Virginia

Note: #4, #8, #9, #11 refer to the subjects: personal development, administrative structures, marketing management, and managerial accounting.

I am thoroughly convinced that after the engineering education is secured, a man, to be worthwhile in management, must learn many other things. Often he does this of his own accord, but you could actually offer practically everything in the liberal arts course and also, a school of business course, to the advantage of such men, after they have graduated in engineering and gone into busines

N. P. Hayes, Executive Vice President
Carolina Steel and Iron Company
Greensboro, North Carolina

In my opinion, a short course which will enable production engineers to broaden their knowledge of top-level management would be very helpful. . . .

Many plants would like to have such courses available for developing managerial talent. . . .

D. L. Jordan, President
Johnson-Carper Furniture Company, Inc.
Roanoke, Virginia

I wish you every success in trying to develop the executive ability in your graduate engineers, because I think this is something vitally needed.

Kenneth H. Merry, President
Merry Brothers Brick and Tile Co.
Augusta, Georgia

I am of the opinion that a short course pointed toward executive development in engineers is very badly needed. I do not personally believe that engineers today, in colleges in undergraduate work, are taught a sufficient amount of the many liberal subjects dealing with business. Further, it is true in many cases that engineers as a group do not have sufficient selling ability, economics and the general broad administrative subjects so needed in business. This is indeed, if true, a sorry situation of affairs; especially since engineering training develops a type of thinking which is so adaptable to executive management in practically any business.

William D. Owsley, Vice President for
Engineering Advice to Management
Halliburton Oil Well Cementing Company
Duncan, Oklahoma

I am glad to see that educators recognize, that in order for an engineer to become a successful executive, he must have a broader education than acquired by the study of only engineering. . . .

Franklin G. Russell, President
Florida Machine & Foundry Company
Jacksonville, Florida

I am quite certain that such a course would be extremely helpful. .

We, here, certainly feel that an engineering background is the best background for leadership in industry.

Charles Silvers, President
Adams Engineering Co., Inc.
Miami, Florida

FREQUENCY DISTRIBUTION OF RATINGS GIVEN EXECUTIVE DEVELOPMENT SUBJECTS BY TOP SOUTHERN INDUSTRIAL EXECUTIVES

Subjects	Number of Executives Rating Subject as #1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Personnel Administration	12	9	5	5	2	2	5	2	0	0	1	0
Production Management	11	6	8	4	3	4	1	1	2	0	2	1
Management Philosophy and Ethics	9	8	2	6	2	1	3	2	2	5	2	1
Personal Development	6	4	5	5	6	3	3	4	4	0	0	3
Finance Management	1	7	7	2	3	4	6	7	1	2	3	0
Training Techniques	3	3	6	4	3	6	3	4	3	4	2	2
Administrative Structures	2	4	3	5	4	4	7	3	4	5	1	0
Marketing Management	1	4	4	1	4	9	3	2	3	5	3	3
Managerial Accounting	0	1	6	3	5	6	7	3	3	5	2	2
Public Relations	0	0	4	6	4	4	2	5	6	6	4	2
Business in the American Economy	1	2	1	0	4	2	4	4	5	8	9	3
Government Regulations	0	0	0	1	1	0	1	4	3	7	9	17

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